IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicant: Roland A. Wood

Title: SENSOR FOR DUAL WAVELENGTH BANDS

Docket No.: H0001858 (256.112US1)
Filed: June 27, 2001
Examiner: Otilia Gabor

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Serial No.: 09/893,066
Due Date: August 5, 2004
Group Art Unit: 2878

Appeal Brief--Patents
Commissioner for Patents
P.O. Box 1450
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SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
(GENERAL)

PATENT

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APPELLANTS' BRIEF ON APPEAL

Mail Stop Appeal Brief- Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The Appeal Brief is presented in support of the Notice of Appeal to the Board of Patent Appeals and Interferences, filed on June 4, 2004, from the Final Rejection of claims 1-19 of the above-identified application, as set forth in the Final Office Action mailed on March 5, 2004.

This Appeal Brief is filed in triplicate. The Commissioner of Patents and Trademarks is hereby authorized to charge Deposit Account No. 19-0743 in the amount of 330.00 which represents the requisite fee set forth in 37 C.F.R. § 117. The Appellants respectfully request consideration and reversal of the Examiner's rejections of pending claims.

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APPELLANTS' BRIEF ON APPEAL

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1. REAL PARTY IN INTEREST

The real party in interest of the above-captioned patent application is the assignee, HONEYWELL INTERNATIONAL INC.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellant that will have a bearing on the Board's decision in the present appeal.

3. STATUS OF THE CLAIMS

Claims 1-19 are pending in the application and have all been finally rejected. The rejected claims 1-19 are the subject of the present appeal.

4. STATUS OF AMENDMENTS

No amendments have been made subsequent to the Final Office Action mailed to the Appellants on March 5, 2004.

5. SUMMARY OF THE INVENTION

An array of infrared (IR) sensors are combined with an array of visible light sensors in a system for providing night vision to a driver of an automobile. In this context, IR sensors are extremely useful for providing visual images, e.g. of humans and other animals. However, IR devices do not identify other important information such as the color of a traffic light. By combining IR sensors with visible light sensors optimally configured for traffic conditions and signals, the night vision system of the current invention is able to indicate these important objects.

The dual wavelength focal plane of the current invention is composed of two arrays. Each pixel of the first array consists of a microbolometer 135 sensitive to IR wavelengths. Each pixel element of the second array is composed of visible light

photosensors 120, 125 and 130, each provided with a filter 122, 127 and 132 to make the photosensor sensitive to certain visible light color bandwidths. In one embodiment a single photosensor adapted to be reactive to wavelengths corresponding to the color red is used. However, in other preferred embodiments at least three photosensors are used in each pixel, and are configured to optimally sense traffic control signals such as brake lights and traffic lights. As described at page 3, lines 12-18 and shown in figure 1, the pixels are formed by vertically stacking the microbolometers on the visible light photosensors, separated by a thermally-isolating space. An array 210 is formed from a plurality of such pixels.

Connections 215 between the array 210 and a processor 220 allows the information to be transformed into an image to be displayed by display 230. Page 3, lines 19-29; fig. 2. The displayed image may show a monochromatic representation of sensed IR with overlaid color displays of traffic control signals.

6. ISSUE PRESENTED FOR REVIEW

Whether claims 1-19 are patentable under 35 USC § 103(a) over Cooper (U.S. Patent No. 6,150,930) in view of Ouvrier-Buffet et al. (U.S. Patent No. 6,320,189).

7. GROUPING OF CLAIMS

Claims 1-7 are grouped together and argued separately.

Claims 8 and 13 are grouped together and argued separately.

Claims 9, 11 and 15-19 are grouped together and argued separately.

All other claims stand alone and are argued separately.

8. ARGUMENT

1) The Applicable Law

The Examiner has the burden under 35 U.S.C. 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). As part of establishing a *prima facie* case of obviousness, the Examiner must show that some objective teaching in the prior art or some knowledge generally available to one of ordinary skill in the art would lead an individual to combine the relevant teaching of the references. *Id.*

The court in *Fine* stated that:

> Obviousness is tested by "what the combined teaching of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 878 (CCPA 1981)). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." *ACS Hosp. Sys.*, 732 F.2d at 1577, 221 USPQ at 933. And "teachings of references can be combined *only* if there is some suggestion or incentive to do so."

Id. (emphasis in original).

The M.P.E.P. adopts this line of reasoning, stating that:

> "In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellant s disclosure. *In re Vaeck* , 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991))". *M.P.E.P.* 2142

The test for obviousness under § 103 must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985). The Examiner must, as one of the inquiries pertinent to any obviousness inquiry under 35 U.S.C. § 103, recognize and consider not

only the similarities but also the critical differences between the claimed invention and the prior art. *In re Bond*, 910 F.2d 831, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990), *reh'g denied*, 1990 U.S. App. LEXIS 19971 (Fed. Cir. 1990). Finally, the Examiner must avoid hindsight. *Id.*

Anticipation via a single prior art reference requires the disclosure in the reference of each element of the claim under consideration. *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897, 1908 (Fed. Cir. 1990) (en banc), cert. denied, 500 U.S. 904 (1991).

2) Discussion of the Rejection of the Claims Under 35 U.S.C. § 103(a) as being unpatentable over Cooper in view of Ouvrier-Buffet et al.

The Examiner rejected claims 1-19 under 35 USC § 103(a) as being unpatentable over Cooper in view of Ouvrier-Buffet et al.

Claims 1-7 describe two arrays as part of a dual wavelength focal plane. The first array consists of IR sensing pixels and the second array consists of visible light sensing pixels. The Examiner suggests that Cooper discloses multiple arrays when describing detector 34 and readout registers 52, 40, 44, and 48. Applicant respectfully disagrees. Cooper describes a detector with a single array of pixels. Cooper uses "a series of columns of filters to block or absorb undesired electromagnetic radiation and to allow specific wavelengths of electromagnetic radiation to interact with silicon beneath the individual filters." Col. 4, lines 17-21. A single array of detectors are used "[s]ince silicon detectors are sensitive (react to) electromagnetic radiation in both the visible light range and in the short wavelength infrared spectrum." Col. 3, lines 37-39. Thus, Cooper does not disclose two arrays with one containing IR sensors and the other containing visible light sensors. Instead, Cooper describes using a single array of detectors sensitive to both short wavelength IR and visible light, a total spectrum defined by Cooper as wavelengths between about 0.4 and 1.1 microns. Col. 4, lines 36-50.

In contrast, Applicant describes a structure containing two arrays. The first array is comprised of microbolometers and is capable of sensing IR radiation. The second array is comprised of visible light photosensors. This means that while the second array detects light with wavelengths between about 0.4 and 0.7 microns, the first array may

detect IR radiation for much longer wavelengths than 1.1 microns. Therefore, the structure taught by Applicant is much different than anything discussed by Cooper.

Furthermore, this difference in structure is not a superficial alteration, but allows for significant advantages. To obtain the short wavelengths in the infrared spectrum, Cooper uses an IR illuminator 26. Col. 3, lines 6-23. In contrast, the longer wavelengths detected by the invention described by Applicant are typically emitted by objects to be detected. For example, the peak wavelength of the heat energy emitted by humans is around 10 microns. The alternative structure employed by Applicant does not require the same parts as the system of Cooper.

Claims 1-7 include "a first array of infrared sensing microbolometer pixel elements." Cooper does not teach the use of bolometer IR sensors which sense thermally-emitted IR. Cooper uses a silicon detector at a much shorter wavelength than bolometers use. A microbolometer, as claimed in the current application, is used to detect long wavelengths of IR radiation.

The Final Office Action indicates that "this constitutes only a matter of design choice." In responding to Applicant's arguments, the Examiner defends this position with reference to Kern et al. (U.S. Patent 4,296,624), stating that, "bolometers are very much used as efficient short wavelength detectors." This argument is respectfully traversed. Kern et al. indicates that a thermistor bolometer can be used for detecting heat from fires or explosions, which are very intense sources. Col. 2, lines 30-32. This detection is performed at close range, "the normal application of these sensors is for very close-in distances, a matter of a few meters." Col. 3, lines 64-66. In addition, the short wavelength channel described by Kern et al. has a higher wavelength than the spectrum described by Cooper. Kern et al. explains that "the short wavelength channel 12 includes a suitable conventional optical filter 20 for passing radiation wavelengths only in the spectral band of interest, which preferably is on the order 0.7 to 3.5 μm." Col. 3, lines 10-14. As discussed above, Cooper describes using a single array that is capable of detecting radiation having a wavelength of as low as about 0.4 microns. The Examiner's belief that Kern et al. is evidence of bolometers being used as efficient short wavelength detectors is flawed, because the short wavelengths described by Cooper are not addressed by Kern et al.

In arguing this position, the Examiner combines Ouvrier-Buffet et al. with Cooper, stating in the Final Office Action that "Ouvrier-Buffet uses bolometer sensor elements," and "it would have been obvious to one of ordinary sill in the art to use the conventional pixel arrangement of Ouvrier-Buffet." Applicant submits that a *prima facie* case of obviousness does not exist because there is no motivation to combine the references. A factor cutting against a finding of motivation to combine or modify the prior art is when the prior art teaches away from the claimed combination. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a path divergent from the path the applicant took. *In re Gurley*, 27 F.3d 551, 31 USPQ 2d 1130, 1131 (Fed. Cir. 1994); *United States v. Adams*, 383 U.S. 39, 52, 148 USPQ 479, 484 (1966); *In re Sponnoble*, 405 F.2d 578, 587, 160 USPQ 237, 244 (C.C.P.A. 1969); *In re Caldwell*, 319 F.2d 254, 256, 138 USPQ 243, 245 (C.C.P.A. 1963). While Ouvrier-Buffet does disclose the use of microbolometers, the combination of these references is improper, because Cooper specifically indicates that such a detector "would not provide critical information needed by a motor vehicle operator." Col. 1, lines 36-39. Thus, Cooper teaches away from the use of a microbolometer as claimed by Applicant and there is no motivation to combine the references.

Claims 1-6 also include "a second array of visible light pixel elements responsive to selective colors encountered while driving an automobile such that traffic control colors are optimally sensed." Claim 7 includes similar language. The Examiner states that Cooper discloses this limitation. The relevant language cited by the Examiner is:

> A single silicon detector (34) processes electromagnetic signals in the short wavelength infrared spectrum and selected color signals in the visible light spectrum. A visual display (60) of the operating environment comprising the infrared image with enhancements from selected portions of the colored light spectrum are provided to the operator of the vehicle (20).

Abstract. And also:

> The system includes equipment to process analog signals from the silicon detector and to enhance an infrared image of road conditions in front of the vehicle and selected peripheral conditions with color signals from critical items such as stop lights, traffic lights, and other signals associated with driving safety.

Col. 2, lines 2-7. These references to Cooper only describe standard RGB silicon sensing elements. They are commonly used sensing elements used to sense all colors, and are not optimized in any manner for sensing traffic control signals. While the elements described by Cooper may be able to detect such traffic control signals, there is no evidence or suggestion that "traffic control colors are optimally sensed" as in claims 1-7. The reference to the pixel elements being responsive to selective colors, such that the traffic control colors are optimally sensed, is a recitation that helps define the structures and sets patentable boundaries as indicated in the examples provided in MPEP § 2173.05(g). Since the reference does not describe or suggest any type of optimization for such colors, the rejection should be withdrawn.

Claims 1-7 are believed to be in condition for allowance. The reference cited by the Examiner in rejecting these claims does not disclose each element of the claims. The structure taught by Applicant is very different, having two arrays for detection rather than one. One of those arrays is comprised of microbolometers, a device Cooper teaches away from. Also, the reference does not describe a system in which traffic control colors are optimally sensed. Applicant respectfully requests the withdrawal of the rejections of claims 1-7.

Claims 8 and 13 describes an array of IR sensors and an array of photosensors being vertically integrated into a monolithic silicon substrate, with the microbolometer array being formed above the visible sensor array. The Examiner states in the Final Office Action that this "constitutes only a matter of design choice," and relies on the combination of Cooper and Ouvrier-Buffet et al. in disclosing this limitation. Applicant submits that there is no motivation to combine the references, as discussed above. As stated above with respect to claims 1-7, Cooper discourages the use of a microbolometer as used in Ouvrier-Buffet et al. Thus, Cooper teaches away from Ouvrier-Buffet et al., and the references should not be combined. Cooper does not teach the vertically integrated alignment disclosed by Applicant in claims 8 and 13.

Claims 8 and 13 also include limitations discussed above with respect to claims 1-7, and those arguments are equally relevant to these claims. Claims 8 and 13 include two distinct arrays, one of which is comprised of microbolometers. Both claims also disclose

traffic control colors being optimally sensed. These elements are not disclosed by Cooper and Ouvrier-Buffet et al. Applicant respectfully requests the withdrawal of the rejections of claims 8 and 13.

Claims 9, 11 and 15-19 include structural elements similar to claims 1-7. Specifically, the claims describe two arrays, the first array of IR sensing microbolometer pixel elements and the second of photosensors. As discussed with respect to claims 1-7, Cooper does not disclose two arrays or the use of microbolometers. Additionally, Ouvrier-Buffet et al. cannot be relied on to disclose the use of microbolometers because the combination is improper. Applicant believes that claims 9, 11 and 15-19 are in condition for allowance and respectfully requests the withdrawal of these rejections.

Claim 10 describes using a microbolometer to sense IR radiation sources. This limitation is discussed with respect to claims 1-7, and the arguments are equally applicable to claim 10. Applicant requests the withdrawal of the rejection of claim 10.

Claim 12 describes elements similar to claims 1-7, and also includes a vertically integrated structure like that described in claims 8 and 13. Claim 12 includes two arrays, one being comprised of microbolometers. As discussed with respect to claims 1-7 these limitations are not disclosed by the references. The arguments with respect to the vertically integrated structure discussed with respect to claims 8 and 13 are also applicable to claim 12. Applicant respectfully requests the withdrawal of the rejection of claim 12.

Claim 14 includes "forming red, amber and green visible light filters." As described with respect to claims 1-7, Cooper does not disclose the optimal detection of traffic control colors. The use of an amber filter as opposed to a blue filter is a specific example of a design selection based on this limitation, as amber is common in traffic control signals. The Final Office Action admits with respect to claim 14 that:

> ... Cooper does not specifically disclose amber as one of the selective colors, however, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have amber instead of blue as one of the detected colors since that would be more helpful in identifying all the colors of the traffic light and because Cooper, by disclosing that other types of complimentary filters can be used that pass all visible wavelengths but notch out a particular color, does not limit his invention to detecting only red, green and blue as the selective colors but allows for the detection of other desired colors as well.

Again, it is admitted that an amber filter is not disclosed in the reference and that such a filter would be helpful, but the Examiner appears to be indicating that such a filter is inherent. No proper *prima facie* case of inherency has been established. Further, a reference that mentions that other types of filters can be used does not specifically teach the type of filter claimed. There is no teaching in Cooper of the desirability of using an amber filter, and it cannot be inferred from such a broad statement.

Claim 14 is also dependant on claim 13 and is believed allowable for the same reasons. As discussed above, the references do not properly reject the limitations of two arrays, one being composed of microbolometers and the other optimally sensing traffic controls. The combination of the references cannot be used to teach the vertical alignment of the two arrays because Cooper teaches away from Ouvrier-Buffet et al. Applicant respectfully requests the withdrawal of the rejection of claim 14.

9. SUMMARY

Applicant believes the claims are in condition for allowance and requests withdrawal of the rejections to claims 1-19. Reversal of the Examiner's rejections of claims 1-19 in this appeal is respectfully requested.

Respectfully submitted,

ROLAND A. WOOD

By his Representatives,

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Date 8-4-2004 By [signature]
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Gina M. Uphus — Gina Uphus

Name — Signature

APPENDIX I

The Claims on Appeal

1. (Previously Presented) A dual wavelength focal plane comprising:

a first array of infrared sensing microbolometer pixel elements;

a second array of visible light pixel elements responsive to selective colors encountered while driving an automobile such that traffic control colors are optimally sensed.

2. (Original) The focal plane of claim 1 wherein the second array is selective to the color red.

3. (Original) The focal plane of claim 1 wherein the second array is selective to the colors red, green and blue.

4. (Original) The focal plane of claim 1 wherein the first and second arrays are fabricated on a monolithic silicon substrate.

5. (Original) The focal plane of claim 1 and further comprising a visible light filter that passes red light to the second array of visible light pixel elements.

6. (Original) The focal plane of claim 1 and further comprising multiple filters for selectively passing red, green and blue light to the second array of visible light pixel elements.

7. (Previously Presented) A dual wavelength focal plane comprising:

a first array of infrared sensing microbolometer pixel elements;

a second array of sets of three pixel elements optimally selective to red, blue and green respectively such that traffic control colors are optimally sensed.

8. (Previously Presented) A sensor for aiding an automobile driver at night, the sensor comprising:

a first array of infrared sensing microbolometer pixel elements formed on a silicon substrate;

a second array of sets of three visible sensors optimally responsive to red, blue and green respectively, each set of photosensors formed on the silicon substrate beneath the infrared sensing pixel element such that traffic control colors are optimally sensed.

9. (Previously Presented) A night display system for an automobile, the system comprising:

a first array of infrared sensing microbolometer pixel elements;

a second array of photosensors responsive to traffic control signals; and,

a heads up display coupled to the arrays for generating an image based on infrared images and visible light corresponding to traffic control signals.

10. (Previously Presented) A method of providing a heads up display for enhancing visibility for night time drivers of vehicles, the method comprising:

sensing infrared radiation sources generally in the path of the vehicle using a microbolometer;

selectively sensing visible radiation corresponding to traffic control colors; and

combining the sensed visible radiation and infrared radiation to provide images for the heads up display, wherein the traffic control colors are displayed in color.

11. (Original) The method of claim 10 wherein an array of infrared sensors are used to sense the infrared radiation, and an array of silicon photosensors are used to sense selected colors.

12. (Previously Presented) The method of claim 11 wherein the arrays are vertically integrated into a monolithic silicon substrate to optimize fill factor.

13. (Previously Presented) A method of forming a dual wavelength focal plane, the method comprising:

forming an array of visible light pixel elements optimally selective to colors encountered while driving an automobile, the array being formed on a silicon substrate; and

forming an array of infrared sensing microbolometer pixel elements on top of the array of visible light pixel elements, wherein the infrared sensing pixel elements pass visible light to the array of visible light pixel elements.

14. (Original) The method of claim 13, and further comprising forming red, amber and green visible light filters corresponding to the visible light pixel elements.

15. (Previously Presented) A dual wavelength focal plane comprising:

a first array of infrared sensing microbolometer pixel elements allowing transmission of visible light;

a second array of visible light pixel elements selective to vehicle traffic control colors; and

a thermally isolating space between the first and second arrays.

16. (Previously Presented) A dual wavelength focal plane comprising:

a first array of infrared sensing microbolometer pixel elements allowing transmission of visible light;

a second array of visible light pixel elements;

a third array of filters positioned above the second array of visible light pixel elements to make such pixel elements selective to vehicle traffic control colors; and

a thermally isolating space between the first and third arrays.

17. (Previously Presented) The focal plane of claim 16 wherein the first and second arrays are fabricated on a monolithic silicon substrate.

18. (Previously Presented) A night display system for an automobile, the system

comprising:

a first array of infrared sensing substantially transparent microbolometer pixel elements;

a second array of visible light pixel elements selective to vehicle traffic control colors;

a thermally isolating space between the first and second arrays.

a heads up display coupled to the arrays for generating an image based on infrared images and visible light corresponding to traffic control signals.

19. (Previously Presented) The night display system of claim 17 and further comprising a processor coupled to the arrays and the heads up display controlling the display to show infrared sensed images in monochrome, and visible light sensed images in color